

BIOLOGICAL CHARACTERIZATION OF PVY AS ISOLATED FROM PEPPER IN SPAIN

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ABSTRACT

Eight PVY isolates were characterized by a collection of pepper varieties and test plants. The results suggest that seven of the isolates would correspond to pathotype 0 and one to pathotype 1. Despite the fact that five of the eight isolates studied had been obtained from plants theoretically belonging to variety Yolo Y, only one of them caused symptoms in that variety in experimental conditions. As the resistance in Yolo Y is ruled by a recessive gene and there may be high levels of crossed pollination in pepper, these results seem to indicate that the seeds from Yolo Y used in some cases had not been obtained in conditions of strict isolation, as shown here for Ikeda 1 and Agronómico 10C5, and that although we had intently sought isolates of pathotype 1 in open-air crops in the areas of Valencia and Murcia, we only found it very sparsely. In relation to pepper resistance to PVY, the experimental results suggest that variety Agronómico 10C5 should be included in the group of Florida VR2. Puerto Rico Wonder and Ikeda 1 should also be included in a group of higher resistance than the Yolo Y group.

INTRODUCTION

Potato Virus Y (PVY) is spread all over the world (de BOKX and HUTTINGA, 1981). On pepper, it has been described in countries of temperate climate and in subtropical and tropical areas. In Spain, annual observations and recordings performed ever since 1980 have shown that this virus affects pepper crops in several areas with different intensities (LUIS ARTEAGA and GIL ORTEGA, 1983).

Different PVY isolates were characterized by a collection of pepper varieties, including some local varieties and others carrying resistance genes. In doing so we also attempted to verify the purity of our collection of resistant varieties in order to have homogeneous material available in programs of breeding for resistance and in tests of PVY isolate characterization. The results obtained are summarized in this paper.

MATERIAL AND METHODS

Virus isolates and inoculation method

Eight virus isolates were used, 7 of which had been obtained from peppers in the areas of Murcia and Valencia in 1981 and 1982, and the other one was isolated in 1984 from tomatoes that presented necrotic spots on the leaves (Table 1). All of them had been preserved on Nicotiana tabacum L var Xanthi nc by dehydration at 4 C and propagated on the same species prior to inoculation.

The inoculum was prepared by grinding the fresh tobacco leaves in a solution of 0.03 M PO<sub>4</sub>HNa<sub>2</sub> containing 0.2 p.100 sodium diethyldithiocarbamate at a dosis of 4 ml/g foliar tissue. Carborundum and active charcoal were also added, both at a proportion of 75 mg/ml. The inoculation was performed on pepper plants at the 7-8 leaf stage, inoculating 3 leaves per plant and 3 plants per variety. The plants were kept in greenhouse with heating in

November and December 1984 and January 1985, at a temperature ranging between 12 and 25 °C, in conditions of natural lighting.

#### Plant material

The plant material used included several varieties of the genus Capsicum: Agronômico 10C5, Bastidon, Delray Bell, Doux des Landes, Florida VR2, Florida VR4, Ikeda 1, LP-1, Morrón INIA 106, Morrón INIA 225, Moura, Pimiento L, Puerto Rico Wonder, Serrano Vera Cruz, Tabasco, Yolo Wonder and Yolo Y.

We also inoculated test plants of the following species: Vigna unguiculata (L.) Walp. var. Black local, Phaseolus mungo var. aureus, Nicotiana tabacum L. var. Xanthi nc, Physalis floridana Rydb., Datura stramonium L., Gomphrena globosa L., Chenopodium amaranticolor Coste & Reyn, Cucumis melo L. cv. Doublon, Cucumis sativus L. cv. Marketer and Ocimum basilicum L.

#### Backinoculation from Yolo Y

Using Yolo Y plants that presented mosaic symptoms after inoculation with isolate P62-81 a backinoculation was made on: Agronômico 10C5, Doux des Landes, Florida VR4, Ikeda 1, Morrón INIA 225, Moura, Yolo Wonder and Yolo Y, keeping the plants in greenhouse with heating and artificial lighting.

#### Intravarietal selection and multiplication by lines

Due to the heterogeneous response shown by some varieties with certain isolates, propagation was carried out from individual plants. Three plants of Agronômico 10C5 which were symptomless with isolates that showed no symptoms on Yolo Y, and one Ikeda 1 plant with no symptoms with isolate P62-81 were selected. Three Ikeda 1 plants that had not shown any symptoms with isolates other than P62-81 were also individually propagated.

All the progenies were inoculated in climatized greenhouse with isolates P21-82 and P62-81.

#### RESULTS

##### Response of test plants

No differences were observed in the response of test plants between the different isolates.

No response was obtained on the following species: V. unguiculata var. Black local, P. mungo var. aureus, C. melo, C. sativus, O. basilicum, G. globosa and D. stramonium. N. tabacum var. Xanthi nc showed a systemic response beginning with vein clearing which turned into a soft mottle. C. amaranticolor responded with necrotic lesions on the inoculated leaves. Local necrotic lesions occurred on P. floridana, followed by wilting, apical necrosis and plant death.

##### Response of pepper varieties

The responses observed are summarized in Table 2.

None of the eight isolates did provoke symptom onset in varieties Delray Bell, Florida VR2, Florida VR4, LP-1, Puerto Rico Wonder and Serrano Vera Cruz.

The following varieties proved to be sensitive: Yolo Wonder, which presented vein banding, and Bastidon, Doux des Landes, Morrón INIA 106, Pimiento L and Tabasco, which showed vein necrosis, top necrosis, necrotic streaks on the stems and death of some plants with all the isolates, except for P62-81, which only provoked consistent mild mosaic symptoms and sometimes slight necrosis, but no plant death.

The variety Yolo Y presented vein banding and symptom delay with isolate P62-81, but no symptoms with the rest of the isolates.

Agronómico 10C5 responded in a heterogeneous way towards all the isolates. Some plants did not show any symptoms while other presented severe necrosis.

Morrón INIA 225, with all the isolates except for P57-81, which did not provoke any reaction, showed mild mosaic, and a manifest delay in symptom onset was observed as compared to sensitive varieties.

Ikeda 1 and Moura only presented symptoms in some of the plants with isolate P62-81, but not with the rest of the isolates.

#### Backinoculation from Yolo Y

After retroinoculating from Yolo Y plants showing vein banding caused by isolate P62-81, we observed that symptom onset in Yolo Y, unlike in the first inoculation, was not delayed as compared to other sensitive varieties, such as Doux des Landes and Yolo Wonder.

Varieties Florida VR4, Agronómico 10C5 and Morrón INIA 225 maintained their previous behaviour, i.e., lack of symptoms, heterogeneous reaction and delayed onset of mild symptoms, respectively.

Moura displayed mild symptoms and delayed onset of these, just like Ikeda 1, but this variety only responded this way in one of the three plants inoculated. In both cases the virus was recuperated from the plants with symptoms through backinoculation on indicator plants.

#### Intravarietal selection and multiplication by lines

The responses obtained are summarized in Table 3. Agronómico 10C5 and Ikeda 1 responded to selection by resistance, the first variety giving lines homogeneously resistant to isolates P21-82 and P62-81, and the second one, which was not inoculated with isolate P21-82, to isolate P62-81.

Multiplication of Ikeda 1 by lines enabled us to obtain two resistant lines and one sensitive to both isolates.

#### DISCUSSION

Although no differences have been observed between the isolates in terms of response on the indicator plants used, the behaviour of the pepper varieties enables us to distinguish two groups of isolates. One of them would include P26-81, P55-81, P57-81, P21-82, P77-82, P79-82 and T1-84, with which Yolo Y did not show any kind of symptoms, and the other one would be isolate P62-81, which can cause vein banding on Yolo Y. According to the classification proposed by GEBRE SELASSIE et al. (1985), the first group would correspond to PVY pathotype 0, and the second one to pathotype 1. Our results, however, do not allow us to classify some of our varieties in the variety groups proposed by these authors. Thus, Puerto Rico Wonder, which



according to them should have a behaviour similar to that of Yolo Y, did not show symptoms with any of the isolates. In the case of variety Ikeda 1, which presented a heterogeneous response with isolate P62-81, apparently belonging to pathotype 1, when inoculating the progenies of individual plants, it seems clear that this reaction was due to its heterogeneity in terms of resistance to PVY. Moreover, the selection performed would allow us to classify it, just like Puerto Rico Wonder, if not in the group of Florida VR2, at least in an intermediate group between this one and that of Yolo Y. A group of these characteristics was already proposed by NAGAI and SMITH (1968). The behaviour shown by Agronómico 10C5, with necrosis when inoculated with two isolates and a heterogeneous response with the rest (Table 2) and responding to intravarietal selection (Table 3), suggests that it may have a heterogeneity problem in terms of resistance to PVY, as shown for Ikeda 1. Agronómico 10C5 should probably be classified in the group of Florida VR2. As a matter of fact, Agronómico 10C5 was obtained by crossing Agronómico 8 with Ikeda (NAGAI, 1984), Agronómico 8 being already classified in that group.

Despite the fact that five of the eight isolates studied had been obtained from plants theoretically belonging to variety Yolo Y, only one of them, P62-81, caused symptoms in that variety in experimental conditions. As the resistance in Yolo Y is ruled by a recessive gene (COOK, 1963) and there may be high levels of crossed pollination in pepper (CHRISTOV and GENGEV, 1965), these results seem to indicate that the seeds from Yolo Y used in some cases had not been obtained in conditions of strict isolation, as shown for Ikeda 1 and Agronómico 10C5, and that although we had intently sought isolates of pathotype 1 in open-air crops in the areas of Valencia and Murcia, we only found it very sparsely.

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Table 1 . Isolates of PVY tested.

Isolate	Variety source	Area	Symptoms on infected plants
P26-81	Largo de Reus	M	Necrotic mosaic on leaves. Necrosis on stems and fruits.
P55-81	Yolo Y	M	Mosaic on fruits.
P57-81	Yolo Y	M	Mosaic on fruits.
P62-81	Yolo Y	M	Vein banding on leaves.
P21-82	Morrón INIA 65-4	V	Necrotic mosaic on leaves.
P77-82	Yolo Y	V	Vein banding on leaves.
P79-82	Yolo Y	V	Necrotic mosaic on leaves.
T1-84	----	M	Necrotic spots on leaves.

P = Pepper; T = Tomato. M = Murcia; V = Valencia.

Table 3 . Response of pepper lines to two isolates of PVY.

Variety	Line No	Reaction to isolate	
		P21-82	P62-81
Intravarietal selection for resistance			
Agrônômico 10 C5	2	0	0
	3	0	0
	4	0	0
Ikeda 1	1	-	0
Multiplication by lines			
Ikeda 1	1	0	0
	6	M	M
	9	0	0

M = Mosaic; 0 = No reaction.

Table 2. Response of different pepper varieties to several PVY isolates.

PVY Isolate Variety	P26-81	P55-81	P57-81	P62-81	P21-82	P77-82	P79-82	T1-84
Agronómico 10 C5	N	N	HR	HR	HR	HR	HR	HR
Bastidon	N	N	N	N	N	N	N	N
Delray Bell	O	O	O	O	O	O	O	O
Doux de Landés	N	N	N	M SD	N	N	N	N
Florida VR2	O	O	O	O	O	O	O	O
Florida VR4	O	O	O	O	O	O	O	O
Ikeda 1	O	O	O	HR	O	O	O	O
IP-1	O	O	O	O	O	O	O	O
Morrón INIA 106	N	N	N	M	N	N	N	N
Morrón INIA 225	HR SD	m SD	O	m SD	m SD	m SD	m SD	m SD
Moura	O	O	O	HR	O	O	O	O
Pimiento L	N	N	N	M NS	N	N	N	N
Puerto Rico Wonder	O	O	O	O	O	O	O	O
Serrano Vera Cruz	O	O	O	O	O	O	O	O
Tabasco	N	N	N	M NS SD	N	N	N	N
Yolo Wonder	M	M	M	M SD	M	M	M	M
Yolo Y	O	O	O	M SD	O	O	O	O

M = Vein banding; m = Mild mosaic; N = Vein necrosis, top necrosis; O = No reaction;

SD = Symptom delay; HR = Heterogeneous response; NS = Necrotic spots.